

**B.Tech. - VIEP - ELECTRICAL ENGINEERING
(BTELVI)**

00073 Term-End Examination

June, 2018

BIEEE-018 : ADVANCED POWER ELECTRONICS

Time : 3 hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks. Missing data, if any, may be suitably assumed. Use of scientific calculator is permitted.

1. (a) What is GTO ? Describe its basic structure. Describe the switching performance in a GTO with relevant voltage and current wave and waveform. 10
- (b) Compute the total power loss for MOSFET having the following parameters : 4
 $V_{DS} = 120 \text{ V}$, $I_D = 4 \text{ A}$, $t_r = 120 \text{ ns}$, $I_{DSS} = 2 \text{ mA}$,
 $R_{DS}(\text{on}) = 0.2 \Omega$, duty cycle $D = 50\%$ and frequency = 45 kHz.

2. (a) Discuss the basic structure of IGBT. Also explain the switching characteristics of IGBT. 8

- (b) A bipolar transistor shown in Figure 1 has current gain $\beta = 40$. The load resistance $R_C = 10 \Omega$, dc supply voltage $V_{CC} = 130 \text{ V}$ and input voltage to base circuit $V_B = 10 \text{ V}$. For $V_{CES} = 1.0 \text{ V}$ and $V_{BES} = 1.5 \text{ V}$, calculate

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- (i) the value of R_B for operation in the saturated state.
- (ii) the value of R_B for an overdrive factor 5.
- (iii) the forced current gain.
- (iv) the power loss in the transistor for both parts (a) and (b).

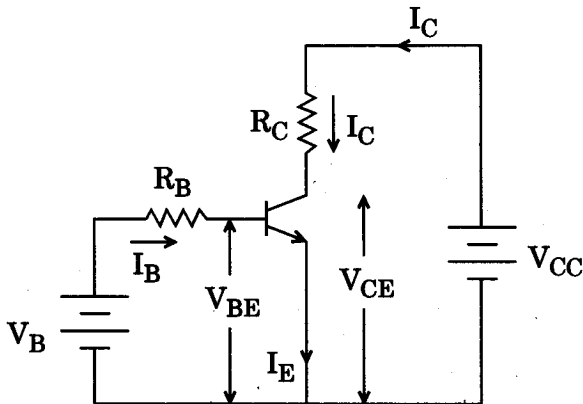


Figure 1

3. (a) With the help of a circuit diagram and waveform, explain the working of a single-phase fully controlled rectifier. 8
- (b) Derive an expression for the average voltage across an R-L load for a single-phase fully controlled rectifier. 6
4. Draw the circuit diagram and explain the working of a three-phase bridge rectifier with R-L load and firing angle of 60° with necessary mathematical calculations and also draw the waveforms for input-output voltage and for input-output current. 14
5. (a) Explain the operation of a three-phase bridge voltage source inverter with neat schematic diagram. 7
- (b) A three-phase bridge voltage source inverter feeds a three-phase star connected resistive load. Obtain the output phase and line voltage if three SCRs conduct at a time. 7
6. In an inverter operation harmonic control is an important step. Mention the different methods available for harmonic reduction and explain any two methods in detail. 14

7. Describe a single-phase capacitor commutated CSI connected to load R with the help of its power circuit diagram and waveforms for getting signals, load current, capacitor voltage, capacitor current, input voltage and voltage across one thyristor.

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8. Write short notes on any *two* of the following :

2×7=14

- (a) Shunt Reactive Power Compensator
 - (b) Power MOSFET
 - (c) Single-Phase Active Power Filter
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